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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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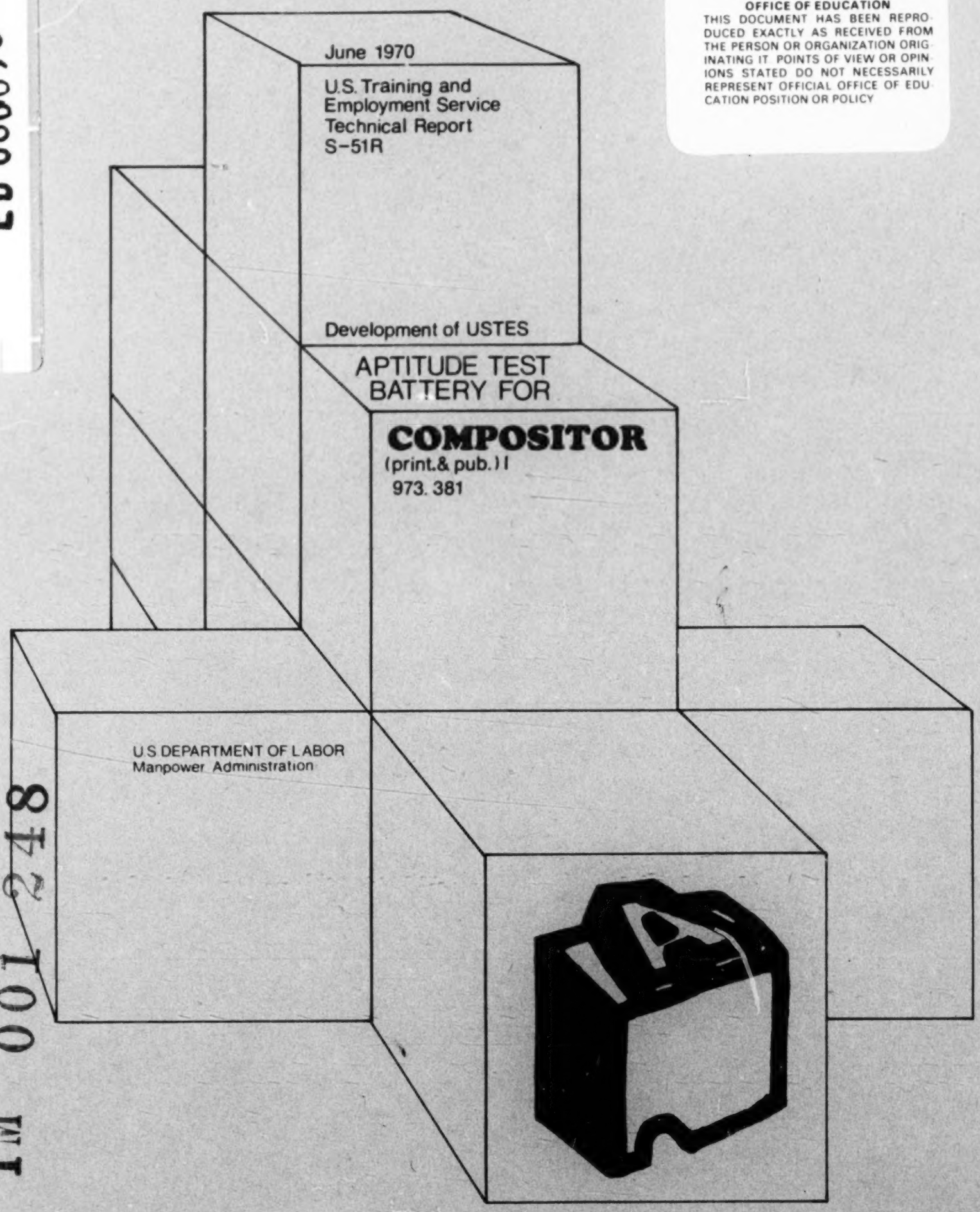

TM 001 248

Technical Report on Development of USTES Aptitude Test Battery

For . . . .

Compositor (print & pub.) I 973.381

S-51R

(Developed in Cooperation with the Pennsylvania and Wisconsin State Employment Services)

U.S. Department of Labor
Manpower Administration

June 1970

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #761 and 2008

Development of USTES Aptitude Test Battery

For

Compositor (print & publ) I 973.381-010

S-51R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Compositor (print & pub.) I 973.381-010. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	85
Q - Clerical Perception	95
M - Manual Dexterity	90

Research Summary

Sample:

107 male workers employed as Compositors in Pennsylvania and Wisconsin. This study group was conducted prior to the requirement of providing minority group information. Therefore, minority group status is unknown.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .36 ($P/2 < .005$)

Effectiveness of Norms:

Only 70% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 84% would have been good workers. Thirty percent of the nontest-selected workers used for this study were poor workers; if the workers

had been test-selected with the above norms, only 16% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE I

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	70%	84%
Poor Workers	30%	16%

SAMPLE DESCRIPTION

Size:

N = 107

Occupational Status:

Employed Workers

Work Setting:

Workers were employed by three Pittsburgh newspapers and 9 firms in Milwaukee and 3 firms in Madison.

Employer Selection Requirements:

Education: None required.

Previous Experience: None required.

Tests: None used.

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the final sample had at least four years job experience.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

	Mean	SD	Range	r
Age (years)	38.7	7.9	23-59	.026
Education (years)	10.7	2.1	6-17	.027
Experience (months)	214.1	113.1	48-444	.077

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1001 or B-1002A were administered in 1952 and 1953. The B-1001 scores have been converted to equivalent B-1002 scores.

CRITERION

The criterion for the Pennsylvania sample was rank-order ratings obtained from the first-line supervisors in each of the three Pittsburgh newspapers. Each set of rank order ratings were converted to linear scores. The three sets of linear scores were subsequently combined into one distribution.

The criterion for the Wisconsin sample consists of supervisory ratings made by the Department Foreman, Supervisor, or Plant Superintendent of each firm participating in the test development project. In only one plant was more than one rating obtained. This was the largest plant participating, and these two ratings were highly consistent. Because of the small number of workers tested from each of the other plants, it was deemed unnecessary to obtain re-ratings. Each worker was rated on the quality and quantity of work produced. Each rater ranked the workers in his plant in the order of their ability and divided the workers into three categories, above average, average, and below average as compared to "Compositors in general." For statistical analysis these broad category ratings were converted into quantitative scores. The above average group had 19 workers, the average group had 24 workers, and the below average group had 13 workers.

Since both samples consisted of Compositors who had undergone substantially the same type of training and performed substantially the same type of work the two samples were combined into one total sample on the basis of statistical and qualitative considerations.

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as the tests were administered with a time interval of two weeks between the two ratings. The immediate supervisor rated each worker.

Rating Scale:

USTES Form SP-21 "Descriptive Rating Scale" was used. The scale (see Appendix) consists of nine items covering different aspects of job performance. Each item has five alternative responses corresponding to different degrees of job proficiency.

Reliability:

A reliability coefficient of .953 was obtained between the initial ratings and the re-ratings, indicating a significant relationship. The final criterion score consists of the combined scores of the two ratings.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	35-90
Mean:	63.4
Standard Deviation:	13.8

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 30% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers."

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
G - General Learning Ability	Required in learning the various phases of this skilled occupation and in following detailed written and oral instructions accurately.

V - Verbal Aptitude	Required in understanding the meaning of words when reading copy and written instructions, and for knowledge of proper spelling, grammar and punctuation.
S - Spatial Aptitude	Required in visualizing completed jobs and in using good basic design, balance and fitness of type-face and spacing.
Q - Clerical Perception	Required in avoiding and detecting errors in setting type and in reading copy.
M - Manual Dexterity	Required in using arms and hands rapidly in setting and breaking up type, in assembling type and cuts in galleys, in taking off proof, and in operating slug cutter, power saw, mitering machine and Ludlow machine.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N= 107

	Mean	SD	Range	r
G - General Learning Ability	106.4	15.7	75-143	.346**
V - Verbal Aptitude	106.5	15.3	71-146	.330**
N - Numerical Aptitude	100.9	14.1	63-135	.380**
S - Spatial Aptitude	104.9	19.0	63-156	.172
P - Form Perception	98.8	15.2	62-142	.168
Q - Clerical Perception	105.3	14.0	76-142	.316**
K - Motor Coordination	103.3	14.3	62-138	.261**
F - Finger Dexterity	103.1	18.0	63-148	.134
M - Manual Dexterity	111.1	18.8	53-165	.271**

**Significant at the .01 level.

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X	X		X		X			X
Irrelevant									
Relatively High Mean	X	X							X
Relatively Low Standard Dev.			X			X	X		
Significant Correlation with Criterion	X	X	X			X	X		X
Aptitudes to be Considered for Trial Norms	G	V	N			Q	K		M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes G, V, N, Q, K and M at trial cutting scores were able to differentiate between the 70% of the sample considered to be good workers and the 30% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about one-third of the sample; for two-aptitude trial norms, minimum catting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of N-85, Q-95 and M-90 provided optimum differentiation for the occupation of Compositor (print & pub.) I 973.381-010. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .37 (statistically significant at the .0005 level).

TABLE 6
Concurrent Validity of Test Norms
N-85, Q-95, M-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	18	57	75
Poor Workers	21	11	32
Total	39	68	107

Phi Coefficient = .37

Chi square (χ^2) = 15.0

Significance Level = P < .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-17 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery. A Phi Coefficient of .35 is obtained with the OAP-17 norms of G-90, V-90, and Q-100.

SP-21

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only <u>one</u> box should be checked for each question.

Name of Worker (print) _____
(Last) **(First)**

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ **See him at work all the time.**

☐ **See him at work several times a day.**

☐ **See him at work several times a week.**

☐ **Seldom see him in work situation.**

How long have you worked with him?

☐ **Under one month.**

☐ **One to two months.**

☐ **Three to five months.**

☐ **Six months or more.**

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

▱ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

▱ 2. Capable of low work output. Can perform at a slow pace.

▱ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

▱ 4. Capable of high work output. Can perform at a fast pace.

▱ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

▱ 1. Performance is inferior and almost never meets minimum quality standards.

▱ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

▱ 3. Performance is acceptable but usually not superior in quality.

▱ 4. Performance is usually superior in quality.

▱ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

▱ 1. Makes very many mistakes. Work needs constant checking.

▱ 2. Makes frequent mistakes. Work needs more checking than is desirable.

▱ 3. Makes mistakes occasionally. Work needs only normal checking.

▱ 4. Makes few mistakes. Work seldom needs checking.

▱ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and <u>only</u> these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

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June 1970 FACT SHEET S-51R

Job Title: Compositor (print. & pub.) I 973.381-010

Job Summary: Performs any or all of the duties concerned with the hand and machine setting of type, the assembling of type and cuts in chases, and related duties prior to the actual printing operations.

Work Performed:

1. Sets up and operates linotype machine: Receives copy from supervisor together with information on type and measurements and places it on copyboard. Studies copy; selects magazine of proper size and style of matrices and brings it into operating position by turning hand wheel or pushing a lever up or down on machine. Manually adjusts assembler gage and marginal stops for width and thickness of line to be formed; selects proper-sized mold by turning hand wheel; sets gage on mold. Operates keyboard of machine: Depresses keys, following copy; removes errors from assembled line and inserts matrices by hand; presses hand lever, casting each line as completed. Continues process for each line of copy by machine, and by hand when making corrections, and transfers completed galley of type to composing table. Resets lines of type from corrected proofs on linotype machine. Maintains machine. Makes minor adjustments to keep machine in proper working order; summons machinist if major breakdown of machine occurs.

2. Sets type and assembles it by hand: Studies lay-out ad and copy, which contains instructions on the size and face of type and length of lines. Selects case containing proper type. Sets composing stick to correct measure. Picks out proper size and style of type characters, and inserts them in composing stick. Removes type from composing stick onto a galley. Ties type in galley by winding gum bands around galley. Levels type by placing flat wooden block over it and tapping block lightly several times with mallet. Inks type and imprints type on proof paper by using a proof press. Corrects type-form by replacing units of faulty or mis-assembled type with fingers or tweezers.

3. Arranges linotype slugs in correct story form in galleys: Studies copy followed by, and inspects type set by, linotype operator. Uses small electric circular saw to cut takes to required length. Corrects story type slugs: Examines slugs and checks them against proof to determine if error has been corrected and no other errors made. Locates story on correction table and ascertains that it is the correct story. Locates and removes incorrect lines in story by use of make-up rule and fingers to lift out slug. Inserts manually and using make-up rule corrected slug to prepare story for Make-Up Department. Places proof and copy side by side on reading board, reads proof against copy a line at a time. Marks by standardized code, error that appears in proof. Queries usage of word or words where obviously wrong, by submitting copy to editorial room.

4. Operates Ludlow machine: Assembles and sets type. Receives copy with information to use in making up large heads. Places copy to be read in copy holder. Sets type manually according to specified width of line. Adjusts clamp on Ludlow assembly stick for specified ems (length). Reads copy, picks matrices from Ludlow composing stand and sets them in assembly stick, letter for letter according to copy. Inserts breakers between matrices at specified marks on assembly stick if line is above 22 1/2 ems. Places spaces between words and quads in indentations at ends of lines to separate words, to make lines of required length and to maintain approximate uniformity of spacing. Manually tightens clamp on stick to hold matrices securely in place. Slides assembly stick containing matrices into slot on top of machine under holding-arm. Locks stick securely in position by pushing down on arm of locking device. Pushes finger lever to actuate casting and ejection of slug into receiving tray. Manually slides assembly stick from under open

holding-arm. Visually checks type slug for errors before distributing matrices. Corrects errors found and recasts line. Checks whether breakers inserted in assembly stick are in correct position under holding-arm of machine and changes breaker to correct position if not properly placed. Pushes button to start machine to reproduce automatically printed characters on metal slugs, corresponding to characters on matrices up to the point where breaker is positioned. Slides assembly stick forward until next breaker comes to rest at stop under holding-arm and actuates machine to reproduce another part of the line. Continues same process until entire line is cast. Assembles sections of slugs reproduced, and places them end to end to form completed line. Removes assembly stick from slot. Loosens clamp on stick to remove matrices and distributes matrices in compartments of Ludlow composing cases. Cuts under-lays and slugs by electrically driven saw to specified lengths and places underlays beneath extended characters of line.

5. Arranges and locks corrected set-ups of type, cuts and headings in chases in the positions that they are to appear on printed plates. Positions chase on imposing stone to receive advertising matter and slugs. Studies copy of lay-out of advertising. Lifts manually and/or slides from galleys the advertising matter and arranges it in the chase on the imposing stone. Studies lay-out of news. Lifts manually the news items (slugs) from the galley and arranges them in the chase according to the lay-out. Fits the news items into the proper places and installs leads, spaces, rules, furniture and wood (spacing devices). Uses make-up rule to assist in working in close places and "slug cutter" to cut leads to the required length. Makes the final check for errors while making-up work. Fills any remaining space with news from storage. Lays planer on format of page and taps with a mallet to properly position type in chase. Secures type in chase by tightening bolts with wrench. Studies lay-out of news items and advertising submitted by editorial staff immediately after the current edition has gone to press to rearrange news items and ads for subsequent editions. Identifies news items affected and moves story from one location to another depending on new instructions contained in lay-out. Justifies lines and columns of story in page as in make-up for the first edition. Secures type in chase by tightening bolts with wrench to make page ready for stereotyping department.

Plans page lay-out of illustrative material, such as sketches, photographs, and diagrams for use in preparing newspaper advertisements from rough sketches: Checks size of rough lay-out to be sure that it conforms to the space size on the order as to number of columns (*of in width and depth by measuring with line gauge. Determines the amount of copy to (type be inserted from the type of merchandise to be advertised, determines the size and (face kind* from the amount of space the cuts and mats will occupy in the space size (to use purchased. Refers to copy fitting chart or applies formula to compute number of characters of a given size that can be fitted into a given space. Blocks off lines of copy and indicates by marking with pencil, the size and kind of type face compositor is to use in setting the lines within the blocked area. Checks all cuts or mats for possible mortises or joints. Checks copy for main item or feature of copy and positions it in lay-out to obtain maximum effectiveness or create eye appeal by proper spacing. Estimates margins, borders, space for signature, address and telephone numbers of advertiser, and marks lay-out to aid compositor in making set-up.

Effectiveness of Norms: Only 70% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-51R norms 84% would have been good workers. 30% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-51R norms, only 16% would have been poor workers.

Applicability of S-51R Norms: The aptitude test battery is applicable to jobs which include a majority of duties described above.

GPO 898.816

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